

Paternal Depression in the Postnatal Period and Child Development: Mediators and Moderators

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abstract

OBJECTIVE: To explore potential mediating and moderating factors that influence the association between paternal depression in the postnatal period and subsequent child behavioral and emotional problems.

METHODS: A population-based cohort ($N = 13\,822$) from the Avon Longitudinal Study of Parents and Children (ALSPAC) was recruited during pregnancy. Paternal and maternal depressive symptoms were assessed with the Edinburgh Postnatal Depression Scale at 8 weeks after the birth of the child. Child outcomes were assessed at 3.5 years by using the Rutter revised preschool scales and at 7 years by using the Strengths and Difficulties Questionnaire. Path analysis was used to assess hypothesized mediators (ie, depression in the other parent, couple conflict, and paternal noninvolvement) of the associations between both paternal and maternal depression and child outcomes. We also tested for hypothesized moderators (ie, paternal education and antisocial traits).

RESULTS: Family factors (maternal depression and couple conflict) mediated two-thirds of the overall association between paternal depression and child outcomes at 3.5 years. Similar findings were seen when children were 7 years old. In contrast, family factors mediated less than one-quarter of the association between maternal depression and child outcomes. There was no evidence of moderating effects of either parental education or antisocial traits.

CONCLUSIONS: The majority of the association between depression in fathers postnatally and subsequent child behavior is explained by the mediating role of family environment, whereas the association between depression in mothers and child outcomes appears to be better explained by other factors, perhaps including direct mother-infant interaction.

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Dr Gutierrez-Galve developed the hypotheses for the current study, carried out the statistical analysis, drafted the initial manuscript, and serves as guarantor for the contents of this article; Mr Stein, Dr Hanington, and Dr Heron developed the hypotheses for the current study and critically reviewed the manuscript; Dr Ramchandani developed the hypotheses for this study, supervised the statistical analysis, and reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

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WHAT'S KNOWN ON THIS SUBJECT: Parental depression is associated with adverse child outcomes. It is important to understand possible mediators and moderators. Several studies suggest that the family environment or parenting style may be potential pathways for transmission of risk from parents to children.

WHAT THIS STUDY ADDS: Paternal depression appears to exert its influence on children's outcomes through an effect on family functioning (couple conflict and maternal depression), whereas maternal postnatal depression appears to affect children through other mechanisms, potentially including direct mother-infant interaction and care.

Depression commonly affects adults of parenting age. Parental depression is a risk factor for depression, anxiety, and conduct disorder in offspring.^{1,2} A recent meta-analysis reported that the incidence of depression during the postnatal period is ~9.8% in mothers and 4.8% in fathers.³ Depression in parents can also affect the wider family. The impact of maternal depression in the postnatal period on child development has received considerable attention.^{4–6} Depression in resident fathers increases by 68% through the child's first 5 years of life.⁷ There are fewer studies that have investigated the impact of paternal depression on children; however, those that have also show consistent associations between paternal depression postnatally and an increased risk of behavioral and emotional problems in children between 3 and 5 years old.^{8–10} Children of fathers with depression had higher rates of such problems than children whose fathers had not been depressed (16.9% vs 8.5%).⁹

Despite the reported associations between depression in parents and adverse child outcomes, there is only limited information about the mechanisms by which any risk is transmitted from parents to children or whether there are factors that moderate the potential impact. An understanding of potential mechanisms is important if interventions are to be targeted appropriately. A seminal review¹¹ proposed 4 mechanisms associated with risk transmission from maternal depression to infants: heritability of depression, dysfunctional neuroregulatory mechanisms, and exposure to negative behaviors or cognitions associated with depression and environmental stress.

Several studies suggest that parental psychopathology may affect child development through an impact on parenting style and family environment. Depression in parents

has been found to affect children's behavior indirectly through parenting behavior,^{12,13} although parenting styles as a mechanism of risk transmission differ between mothers and fathers.¹⁴ There is some evidence that maternal depression may be more closely associated with disrupted parenting quality than paternal depression.¹⁵ Mothers with depression may show decreased sensitivity to their children's needs,¹⁶ and changes in maternal behavior have been found to mediate the association between maternal depression and toddlers' behavioral problems.¹⁷ Couple conflict is another potential mechanism of risk transmission.^{18–20} Couple conflict has been found to mediate partially the relationship between depression in both mothers and fathers postnatally and child outcomes at 42 months.²¹

Other factors may also affect the strength of the association between depression in parents and child outcomes (ie, moderators). Antisocial personality traits in parents have been associated with an increased risk of psychological problems in offspring,^{22,23} and a double risk effect has been shown in mothers with depression and antisocial personality traits, with both increasing the likelihood for negative outcomes in toddlers.¹⁷ Parental education has also been shown to modify the risk of depression in offspring at age 18 in children exposed to maternal depression in the postnatal period.²⁴

In the current study we sought to explore key potential mediating and moderating factors influencing the association between parental depression postnatally and subsequent child behavioral and emotional problems. We have previously shown an association between depression in fathers and child outcomes at 42⁹ and at 81²⁵ months. For this study we tested 3 specific hypotheses. First, we

hypothesized that maternal depression, couple conflict, and paternal noninvolvement may be potential pathways of risk transmission from paternal depression postnatally to children. Second, we also hypothesized that pathways of risk transmission from paternal depression would differ from those seen in maternal depression. Finally, we hypothesized that the strength of the association between paternal depression and child outcomes may be moderated by antisocial traits and paternal educational level.

METHODS

Participants

The sample comprised participants from the Avon Longitudinal Study of Parents and Children (ALSPAC).^{26–28} ALSPAC is an ongoing, population-based cohort study in the southwest of England. Pregnant women residing in the Bristol area of the United Kingdom, who had an estimated date of delivery between April 1, 1991, and December 31, 1992, were invited to take part, resulting in a cohort of 14 541 pregnancies, which resulted in 13 796 singletons and first-born twins who were alive at 1 year of age. Questionnaires were sent to mothers and fathers at regular points during and after pregnancy. Detailed information about ALSPAC is available online (<http://www.bris.ac.uk/alspac>), and the study Web site also contains details of all of the data that are available through a fully searchable data dictionary (<http://www.bristol.ac.uk/alspac/researchers/data-access/data-dictionary/>). Ethical approval for the study was obtained from the ALSPAC Law and Ethics Committee and local research ethics committees.

In this part of the study, we focused on paternal depression during the postnatal period and subsequent child behavioral and emotional adjustment.

Procedures and Measures

Parental Measures

We used the Edinburgh Postnatal Depression Scale (EPDS) to assess mothers and fathers at 8 weeks and 8 months after the birth of their child. The EPDS is a self-report questionnaire that consists of 10 items.²⁹ Although the EPDS was initially developed to screen for depression in women within the first 6 to 8 weeks of giving birth, it is also useful in the assessment of mothers across and beyond the first postnatal year and has been validated in men.^{30,31} Scores >12 identify a diagnosis of major depressive disorder with a high specificity (95.7%) and sensitivity (81.1%).³² This cutoff was used in the current study for moderating analysis. For mediating analysis we used continuous measurement.

Child Measures

Child outcomes were assessed at 42 and 81 months. Rutter revised preschool scales³³ were completed by mothers at 42 months. Every item describes a characteristic or behavior. Individual items combine to form 3 problem scales (emotional problems, conduct problems, and hyperactivity), and a prosocial behaviors scale. All problem behaviors combine to give a total problems scale, which was used in our analysis. We also used a cutoff of the top 10% of scores on every scale to identify a high-scoring group, as used previously.⁹

The Strengths and Difficulties Questionnaire (SDQ) was completed by parents (by mothers in 97.6% of cases) at 81 months. The SDQ^{34–36} consists of 25 questions, which divide into 5 subscales (emotional problems, hyperactivity, conduct problems, peer problems, and a prosocial score). The first 4 subscale scores can be combined to give a total problems scale, which was used in our analysis.

Other Information Obtained

Information on the following was also obtained:

Parental age: Fathers and mothers reported their age at the time of the child's birth.

Parental education: In week 32 of the pregnancy, mothers were asked about the highest educational qualification of themselves and their partners. A binary variable was created with 1 group including those fathers with an "A level" or higher degree.

Couple conflict: At 8 months after the birth of their infant, mothers were asked about the relationship with their partner. A 9-item scale was used that included questions such as "Do you get angry with your partner?" and "Does your partner listen when you want to talk about your feelings?" Possible answers range from "almost always" to "never." The scale was developed specifically for the ALSPAC study and has been used in other research.³⁷ A single-factor structure (Cronbach's $\alpha > 0.8$ for maternal and paternal data) explained the data, generating an overall measure of couple conflict.

Paternal noninvolvement: At 18 months after the birth of their infant, mothers were asked how often their partners undertook 10 different activities with their child, including bathing, singing, reading, and putting him/her to bed. Responses were on a 5-point scale, from "never" to "every day."

Trouble with police and suspension from school: In week 18 of the pregnancy, fathers were asked about some antisocial traits, eg, history of trouble with police and suspension from school when they were younger than 17 years old. Responses were "yes" or "no."

Alcohol and cannabis misuse: In week 18 of the pregnancy, fathers were asked about history of misuse of alcohol and cannabis in the last

3 months. For alcohol misuse, 2 groups were defined, in which 1 group included those subjects drinking >2 glasses of an alcoholic beverage per day. For cannabis misuse, 2 groups were defined, in which 1 group included those subjects who had smoked cannabis at least once.

Statistical Analysis

Statistical analysis was carried out with Stata 12.0 (StataCorp, College Station, TX). First, bivariate correlations analyzed the degree of association between paternal depression at 8 weeks after the birth of the child, maternal depression at 8 months, couple conflict, paternal noninvolvement, and total child behavior problems at 42 and 81 months.

Next, hypothesized mediators were assessed by using Structural Equation Modeling (SEM). The model included paternal depression at 8 weeks (independent variable); maternal depression at 8 months, couple conflict, and paternal noninvolvement (mediators); and total child behavior problems (dependent variable). We examined 2 types of relationship between variables: (1) direct effect, a direct relationship between paternal depression and child behavior, and (2) indirect effect, the effect of paternal depression on child behavior through each mediator. The significance for each test was set at $P = .05$. Two different models were created for the measures of child outcomes at 42 and 81 months (see Fig 1). Moderate to strong correlations were seen between paternal and maternal education ($r = 0.54$, $P < .001$) and paternal and maternal age ($r = 0.36$, $P < .01$). SEM was performed by using the maximum likelihood estimation. The association of paternal depression with child outcome was adjusted by paternal education and age.

We also assessed hypothesized mediators in the association between

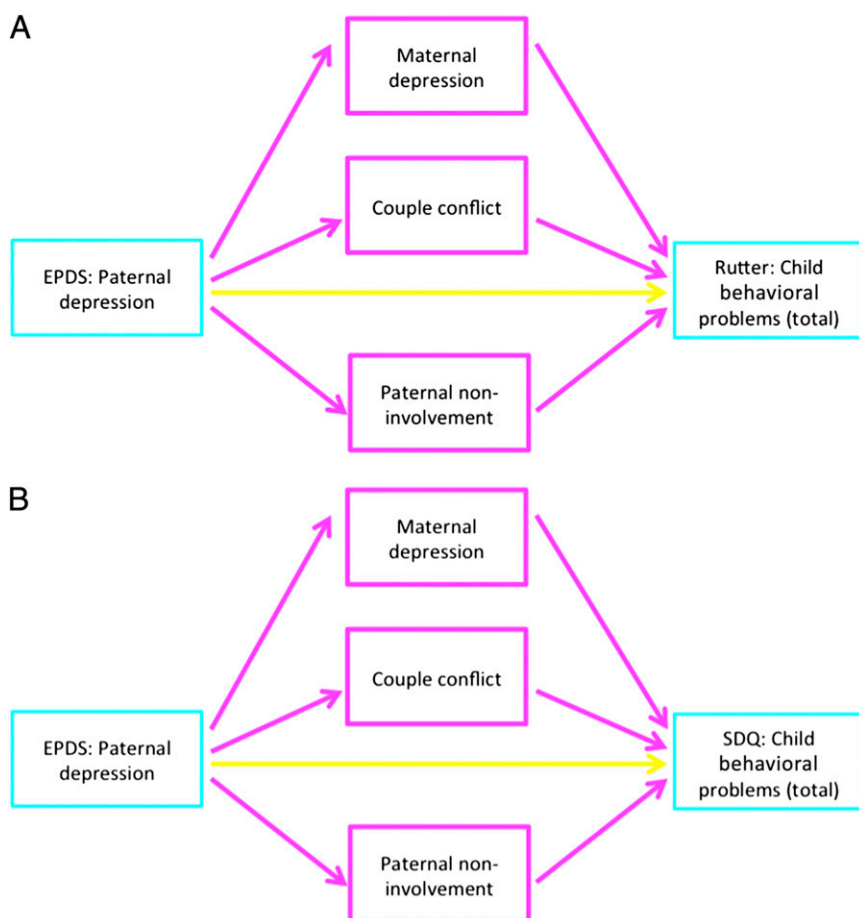


FIGURE 1
Hypothesized pathways in the association between paternal depression at 8 weeks after the birth of the child and total child behavior problems at 42 months (A) and 81 months (B).

maternal depression at 8 weeks after the birth of the child (independent variable) and child behavior problems at 42 months (dependent variable). Mediating factors were paternal depression at 8 months, couple conflict, and paternal noninvolvement.

We were reluctant to rely on a goodness-of-fit test for our SEM models because the χ^2 test is very sensitive to large sample sizes.^{38,39}

Finally, we conducted separate logistic regression models to test hypothesized moderators. Different models were built including paternal depression at 8 weeks and total child behavior problems at 42 months. Analyses used binary variables and compared models with and without interaction terms, testing moderation

effects of paternal education, trouble with police, suspension from school, and misuse of alcohol and cannabis by using likelihood ratio tests. We tested statistical interactions for father's depression by gender with a likelihood ratio test.

RESULTS

A total of 13 351 mothers agreed to participate in the study. Maternal postnatal depression was assessed in 11 833 (89%) mothers and paternal depression postnatally in 8431 of 12 884 (65%) male partners. Questionnaires were completed on children's behavior at 42 months in 10 024 of 13 351 children (75%) and at 81 months in 8401 children (63%). Bivariate correlations are shown in Table 1. All variables were correlated.

Models of Mediation

A total of 7058 fathers and children were included in the path analysis for child outcomes at 42 months. The total effect of paternal depression postnatally on total child psychological problems at 42 months was 0.168 (95% confidence interval [CI]: 0.133–0.202; $P < .001$). This total effect was partitioned into 3 indirect effects: 32.7% (0.055/0.168) was explained by maternal depression, 27.4% (0.046/0.168) by couple conflict, and 5.4% (0.046/0.168) by paternal noninvolvement. The direct effect was 34.5% (0.058/0.168) (see Fig 2).

A total of 6146 fathers and children were included in the path analysis for child outcomes at 81 months. The total effect of paternal depression on total child psychological problems at 81 months was 0.130 (95% CI: 0.098–0.161; $P < .001$). This total effect was partitioned into 3 indirect effects: 32.3% (0.042/0.130) was explained by maternal depression, 27.2% (0.035/0.130) by couple conflict, and 8.4% (0.011/0.130) by paternal noninvolvement. The direct effect was 32.1% (0.042/0.130). Overall, the patterns of mediation seen were very similar for child outcomes at both 42 and 81 months.

We repeated the analysis for maternal depression at 8 weeks after the birth of the child as the exposure variable and total child behavior problems at 42 months as the outcome variable. A total of 9542 mothers and children were included in the analysis. The total effect of postnatal maternal depression on child psychological problems was 0.303 (95% CI: 0.279–0.327; $P < .001$). This effect was minimally explained by paternal depression (2.2%; 0.007/0.303) and couple conflict (18.3%; 0.055/0.303) (see Fig 2).

Models of Moderation

The strong association of paternal depression with increased scores on the total child psychological scale

TABLE 1 Bivariate Correlations Between Paternal Depression at 8 Weeks After the Birth of the Child, Maternal Depression at 8 Months After the Birth of the Child, Couple Conflict, Paternal Noninvolvement, and Child Outcomes at 42 Months

Variable	Variable													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Paternal depression														
2. Maternal depression	0.21													
3. Couple conflict	0.23	0.41												
4. Paternal noninvolvement	−0.11	−0.12	−0.29											
5. Emotional	0.07	0.18	0.13	−0.04										
6. Conduct	0.08	0.17	0.19	−0.09	0.25									
7. Hyperactivity	0.07	0.16	0.13	−0.06	0.25	0.40								
8. Prosocial	−0.02	−0.06	−0.12	0.10	−0.10	−0.23	−0.13							
9. Total	0.11	0.24	0.21	−0.10	0.65	0.76	0.68	−0.23						
SDQ														
10. Emotional	0.07	0.19	0.11	−0.03	0.37	0.15	0.14	−0.06	0.31					
11. Conduct	0.08	0.18	0.20	−0.12	0.17	0.40	0.28	−0.17	0.40	0.30				
12. Hyperactivity	0.06	0.15	0.17	−0.12	0.13	0.30	0.46	−0.17	0.40	0.23	0.47			
13. Peer	0.08	0.15	0.14	−0.11	0.23	0.18	0.16	−0.14	0.28	0.37	0.31	0.28		
14. Prosocial	−0.05	−0.08	−0.12	0.09	−0.09	−0.20	−0.15	0.42	−0.22	−0.02	−0.26	−0.22	−0.14	
15. Total	0.10	0.24	0.22	−0.14	0.31	0.37	0.40	−0.20	0.51	0.64	0.71	0.78	0.63	−0.27

remained after testing for hypothesized moderators (see Tables 2 and 3). There was no evidence of an interaction effect for any of these variables. There were no differences by gender at 42 months (paternal depression by gender interaction, $P = .15$).

DISCUSSION

This study explores potential environmental causal pathways and moderating effects that may explain the association between paternal depression during the postnatal period and psychological problems in children at ages 3.5 and 7 years in a large community sample. Our findings indicate that family factors, including maternal depression, couple conflict, and, to a lesser extent, paternal noninvolvement, explain two-thirds of the total effect of paternal depression postnatally on child outcomes at 3.5 years, with maternal depression and couple conflict accounting for the majority of the mediation seen. Similar findings were seen in children at age 7, although, as expected, the overall strength of the association decreased slightly over the follow-up period. Conversely, the total effect of postnatal maternal depression on subsequent child outcomes was

mediated by less than one-quarter by family factors.

We did not find any moderating effects of either paternal education or antisocial traits on the association between paternal depression during the postnatal period and child outcomes.

Before considering these findings in more detail, it is important to note the strengths and limitations of the current study. This study has a number of strengths. The sample size is large and based on a community sample, limiting the possibility of selection bias. The data were collected prospectively, with the proposed mediating factors measured at a time point between predictor and outcome. The EPDS, Rutter, and SDQ scales have been widely used and well validated, with high sensitivity and specificity.

There are some limitations to consider. First, measures of child behavior and paternal noninvolvement were based on maternal reports. Mothers with depression might rate with higher scores in problem scales, so some degree of reporter bias is possible, although this is unlikely to account for the findings as seen. The use of questionnaires to assess father

involvement, with no directly observed measures, could also have affected correlations between maternal depression and paternal noninvolvement, although those correlations were actually low. Second, the assessment of antisocial traits was not conducted using validated scales and measures were based on paternal reports. Finally, response rates were lower for fathers than for mothers, giving rise to the possibility of response bias. For example, if depressed fathers were less likely to take part in the study, the impact of paternal depression on child outcomes may have been underestimated.

This study suggests that paternal depression during the postnatal period appears to exert its influence on children’s subsequent behavior mainly through family environment mechanisms, ie, maternal depression and couple conflict. Paternal and maternal depression are highly correlated,^{3,8} yet the associations seen with respect to child outcome are different depending on which parent is initially affected. There are a number of possible explanations for this relationship and the dynamics are likely to be complex and varied. Mothers will usually turn to their partner for emotional support after

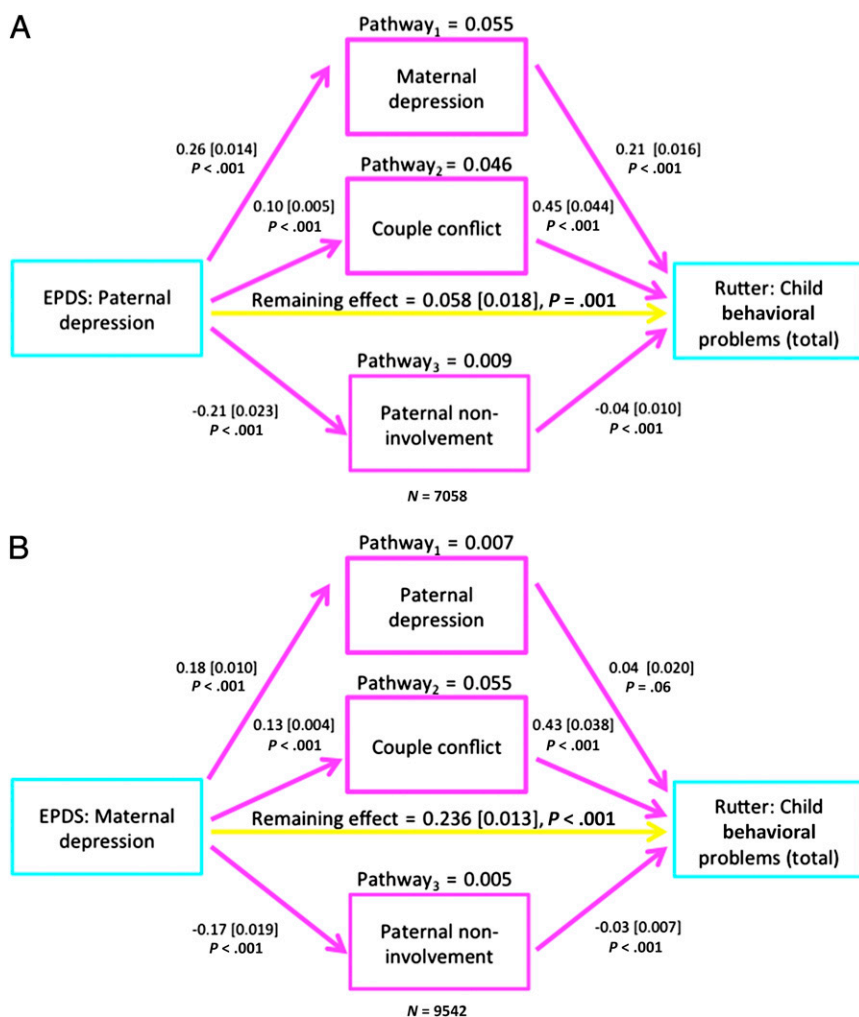


FIGURE 2

Hypothesized pathways in the association between paternal depression (A) and maternal depression (B) at 8 weeks after the birth of the child and total child behavior problems at 42 months. The arrows represent regressions and thus associations between variables. All regression path coefficients are standardized, so all effects sizes are directly comparable. The figure shows regression path coefficients, SEs, and P values for each direct and indirect effect. The effect explained by each pathway was calculated from the product of the regression path coefficients in the figure. A, The total association between paternal depression and child behavioral problems was 0.168 (95% CI: 0.133–0.202; $P < .001$). B, The total association between maternal depression and child behavioral problems was 0.303 (95% CI: 0.279–0.327; $P < .001$).

the birth of their infant and those fathers with depression may have difficulty in providing family support to mothers for the care of their children.^{40,41} On the other hand, fathers with depression during the postnatal period have reported higher

levels of parenting distress and a lower sense of parenting efficacy⁴² and these psychosocial factors have been shown to predispose mothers to depression.^{41,43}

We had previously reported that couple conflict partially mediated the

relationship between depression in fathers postnatally and child outcomes.²¹ We have confirmed these findings using a pathway analysis incorporating other potential pathways and by measurement of child behaviors later in childhood. Parents with depression reported a higher rate of conflict events with their partners after the birth of their child than they did antenatally,²¹ although it has been reported that destructive tactics have more impact on infants than the frequency of couple conflict.¹¹ Specific ways of handling couple conflict based on constructive conflict tactics (problem solving, verbal affection, physical affection) are positively associated with positive children's functioning, and destructive conflict tactics (verbal aggression, nonverbal anger, withdrawal) are associated negatively with child outcomes over time.⁴⁴

In this study, maternal depression during the postnatal period was more strongly associated with subsequent child problems than paternal depression, and the effect of family functioning and environment mediating child outcomes was less crucial. The transmission of risk from maternal depression to children was hardly mediated by couple conflict (18%) and father depression (2%), suggesting that other pathways such as quality of mother-infant interaction⁴⁵ may be more important in the transmission of maternal depression to offspring behavior problems.

Nonetheless, the influence of paternal depression on the quality of father-infant interaction is less well characterized and understood.

In this study, we did not have suitable data to explore the quality of parent-infant

TABLE 2 Crude and Adjusted Associations Between Paternal Depression in the Postnatal Period and Total Child Psychological Problems at 42 Months

Paternal depression	Trouble With Police ($n = 6463$)	Suspension From School ($n = 6463$)	Alcohol Consumption ($n = 6364$)	Cannabis Consumption ($n = 3576$)	Paternal Education ($n = 6787$)
Crude OR (95% CI)	2.30 (1.60–3.30)	2.30 (1.60–3.30)	2.39 (1.66–3.43)	2.39 (1.57–3.65)	2.31 (1.62–3.29)
Adjusted OR (95% CI)	2.26 (1.57–3.24)	2.26 (1.58–3.25)	2.39 (1.67–3.44)	2.34 (1.53–3.58)	2.28 (1.60–3.25)

OR, odds ratio.

TABLE 3 Association Between Paternal Depression in the Postnatal Period and Total Child Behavior Problems at 42 Months Stratified by Potential Moderators

			P for interaction
	No	Yes	
Trouble with police	1.82 (1.15–2.89)	3.47 (1.89–6.36)	.12
<i>n</i>	5359	1104	
Suspension from school	2.55 (1.75–3.73)	0.91 (0.27–3.12)	.15
<i>n</i>	5953	510	
	Not severe	Severe	
Alcohol consumption	2.46 (1.69–3.57)	1.60 (0.34–7.48)	.59
<i>n</i>	6080	284	
	No	Yes	
Cannabis consumption	2.69 (1.72–4.22)	1.01 (0.28–3.58)	.15
<i>n</i>	3299	277	
	Low	High	
Paternal education	2.18 (1.37–3.49)	2.42 (1.42–4.14)	.78
<i>n</i>	3318	3469	

Data are presented as crude odds ratios (95% CIs).

interaction. We used a quantitative measure to assess parenting in fathers with depression (ie, paternal noninvolvement), and the mediating role of paternal noninvolvement was found to explain only 5% of the association between depression in fathers and subsequent child development in our path analysis.

This study suggests that the association between depression in

fathers during the postnatal period and subsequent child behavior is explained predominantly by the mediating role of family factors, such as depression in the mother and couple conflict. In contrast, the association between depression in mothers and child outcomes is only explained to a small degree by these wider family factors and is better explained by other factors, which might include direct effects of

depression on mother-infant interaction.

Overall, these findings highlight the importance of the following: (1) recognizing and treating depression in fathers during the postnatal period (screening programs for both mothers and fathers in the postnatal period should be considered), (2) considering both parents when 1 parent presents with depression, (3) assessing the family environment and functioning with appropriate interventions to enhance the couple and family relationships, and (4) considering the potential for targeted parenting programs to help parents understand their children's needs and to prevent child psychopathology.

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